

Sampling and Analytical

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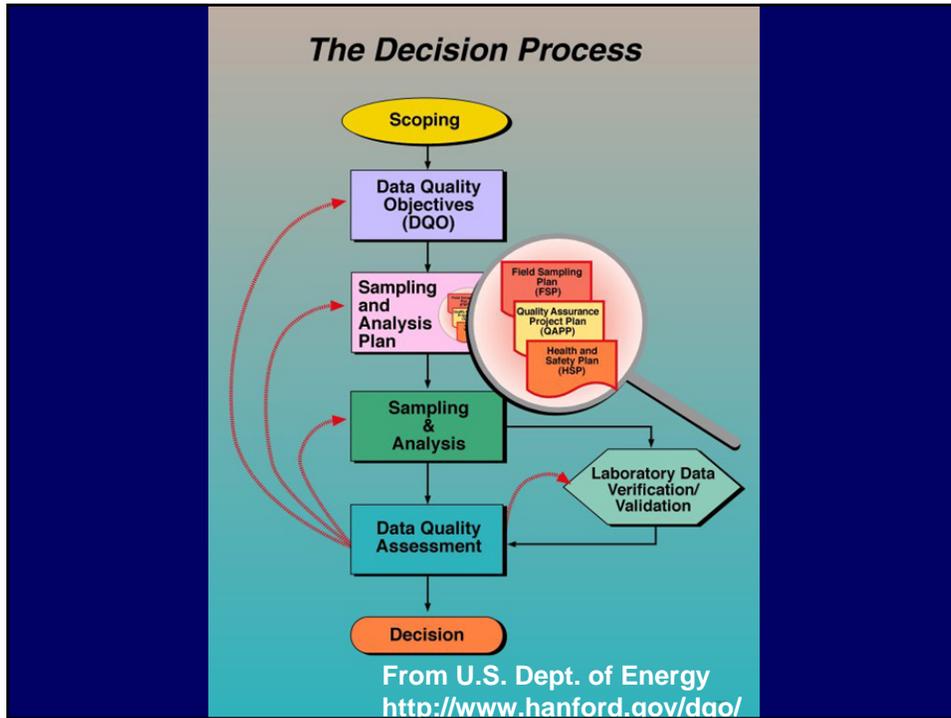
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*Keywords: Sampling and Analysis Plan,
Sampling Design, Data Quality Objectives*

Sampling and Analysis Plan

- Purpose: Implement a project specific sampling plan that will insure adequate and representative samples are collected in a timely and economic manner.





Considerations When Developing A Sampling Plan

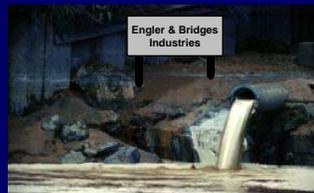
- Identify goal and data needed
- Data quality objectives
- Sample number
- Sample compositing
- Sample site location

Goal and Data Needs

- What is purpose of the study?
 - Characterize the sediment for dredging
 - Locate “hotspots” for clean up
 - Restoration
- What data are needed for study?
 - Existing data
 - Identify data to be collected
- How will data be used in study?

Review of Data

- Geotechnical data
 - Grain size, percent solids, total organic carbon
- Distribution of known contaminants
 - Includes previous data and spill data
- Potential sources of contaminants
 - Industry, sewage plants, farming, harbor activities
- Quality and age of data



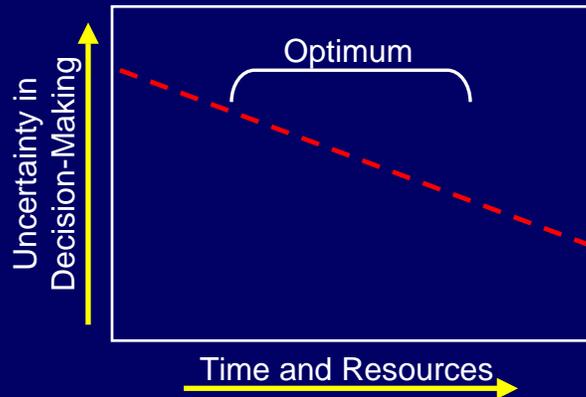
Identify Data Needs

- Based on existing data and study goals
 - Determine quantity and type of samples for analysis
 - Data Quality Objectives. Determine how decisions will be made based on results of sample analysis

What are Data Quality Objectives?

- Think about the question you are trying to answer before you collect your data
- DQOs:
 - Spell out study objectives
 - Identify the type of data needed
 - Specify the acceptable level of variability in data results for purpose of making decision
 - Clarify how the data will be used to make a decision

DQO Balance

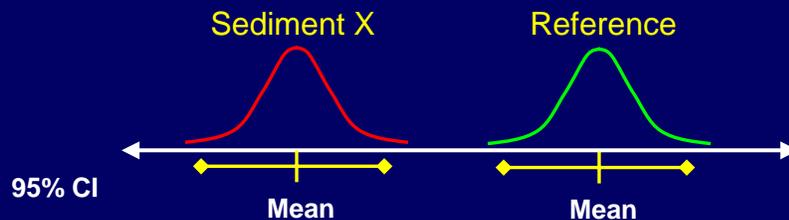


Defining Objectives

- Not appropriate to say “is the sediment clean”
- Need to carefully describe objective
- For example:
 - The decision-maker needs to have 95% confidence that sediment proposed for dredging is similar to reference material.

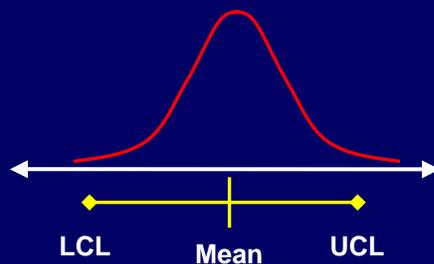
Objectives

- Purpose is to determine with 95% confidence that the material is or is not different from the reference material.
- Compare sample populations.



Sample Number

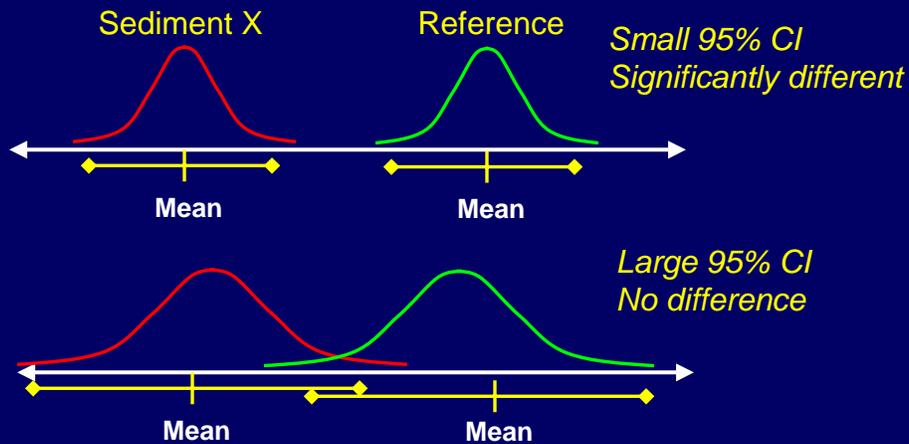
- Number of samples needed is influenced by statistics



- Variability around mean is described by confidence interval (95% CI)
- Confidence interval is controlled by:
 - Population heterogeneity
 - Sample number

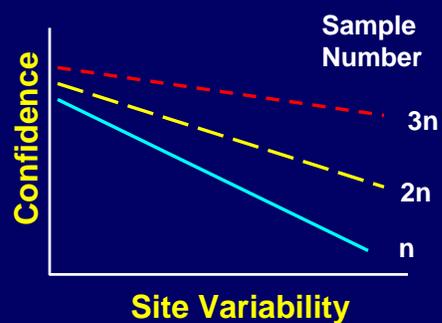
Sample Number

- Compare sample populations



Sample Number

- Number of samples is based on variability of Population and analysis methods and the confidence required to make decision



- Must also consider time / funding constraints

DQO Pro

- Developed by American Chem. Society
- <http://www.envirofacs.org/dqopro.htm>

Calculator for estimating numbers of environmental samples and associated QC samples.

L.H. Keith, G.L. Patton, and P.G. Edwards
Radian International, LLC Austin, Tx.

Success-Calc Calculates the number of samples necessary to detect a specified frequency of some characteristic (such as a rate of false positives, false negatives, or percent contamination)

Enviro-Calc Calculates the number of samples necessary to estimate an average analyte concentration within a specified error (using either standard deviation or relative standard deviation) with a specified confidence.

HotSpot-Calc Calculates the grid size and number of samples necessary to detect a single localized area of pollution with a specified probability of missing the "hot spot". Uses selected grid shapes, hot spot shapes, and confidence levels.

READ THE HELP TEXT FOR INFORMATION ON ASSUMPTIONS AND CORRECT USAGE.

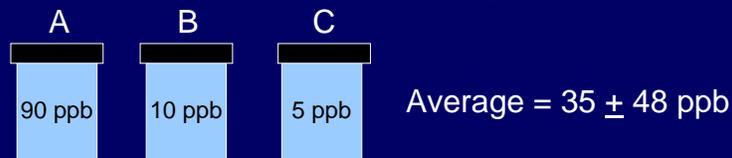
Public Domain Software This program may be freely copied and distributed.

- Sample numbers
- "Hot spot" analysis
- Confidence
- Variability

Sample Compositing

- Collect multiple samples, combine and remove a representative sample from combined samples

- Multiple samples: statistical average



- Compositing: physical average

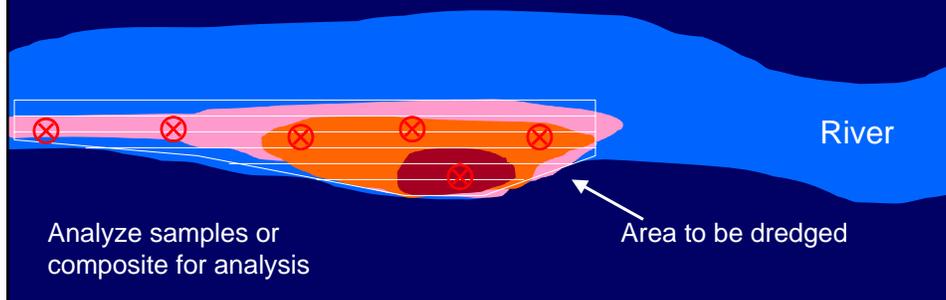


Sample Compositing

- Can be used to decrease analysis cost
- Lose description of variability
- Appropriate when:
 - Chance of finding contaminants is low
 - Dredging projects when material will be mixed
- If concentration of X in sediment is less than screening level / # of samples composited, then none exceed the screening level.

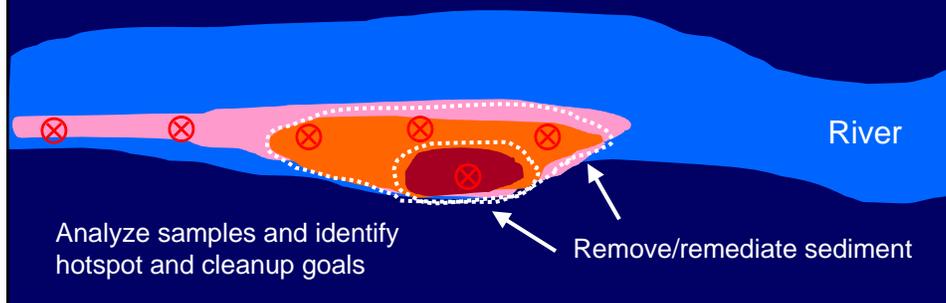
Sampling for DM Assessment

- Goal is to characterize large quantity of material to determine most appropriate management option



Sampling for Superfund Site

- Goal is to find hotspots and clean up or remediate site
- Requires spatial characterization of site

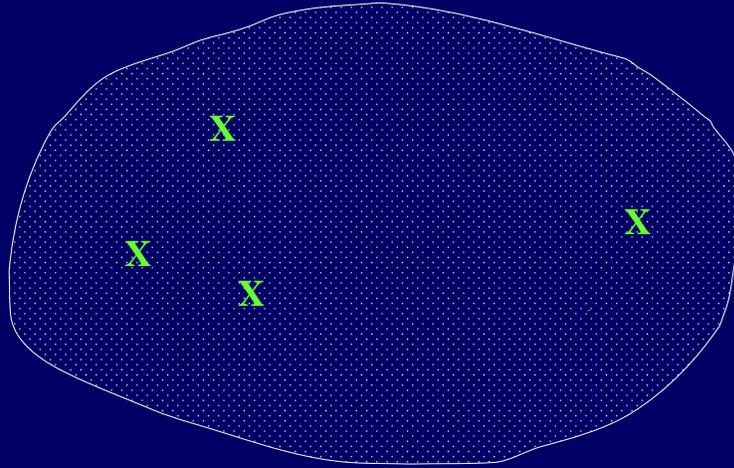


Sample Location

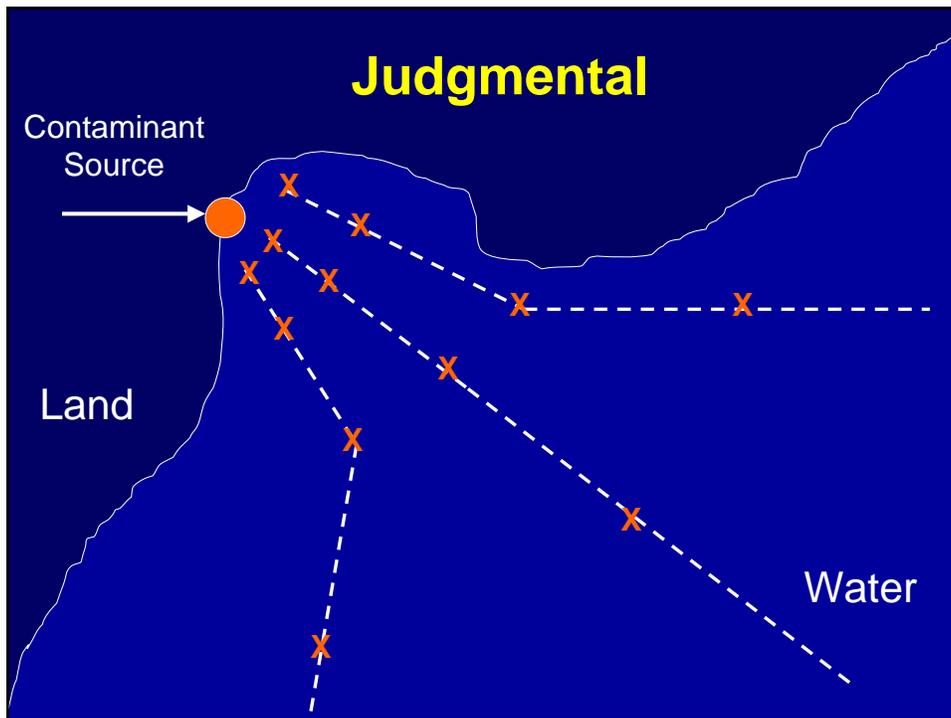
- Distribute sample locations throughout project area
- Avoid sampling bias
- Four main types:
 - Haphazard
 - Judgmental
 - Random
 - Stratified random



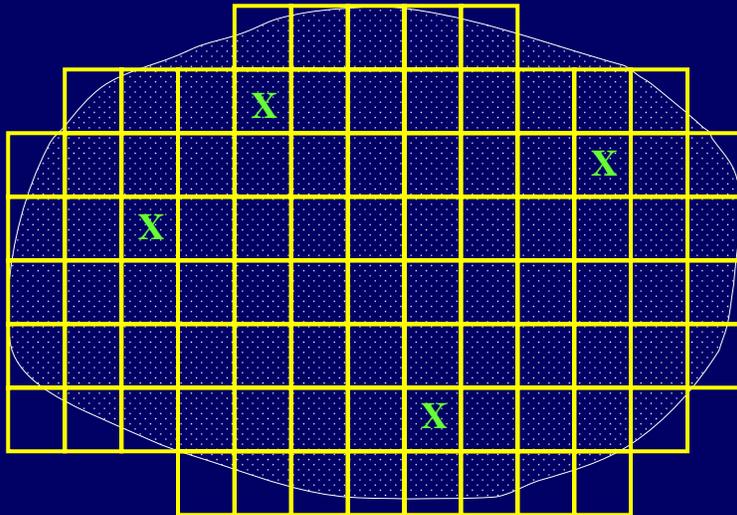
Haphazard Sampling



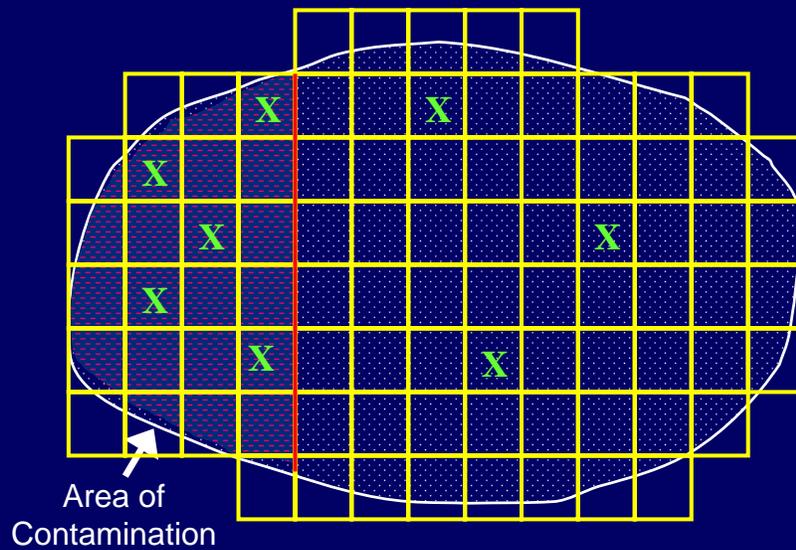
Judgmental



Random Sampling

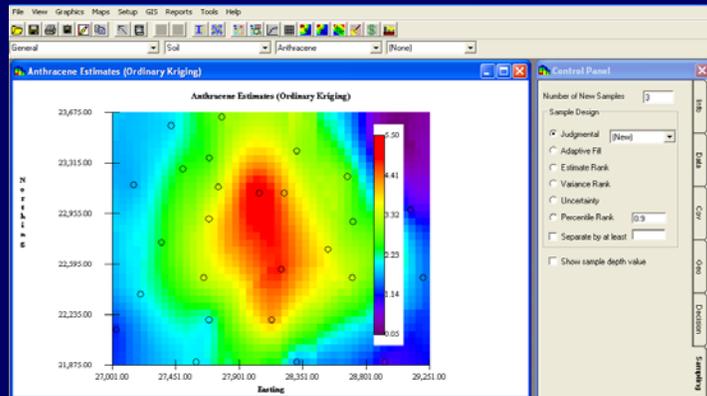


Stratified Random Sampling



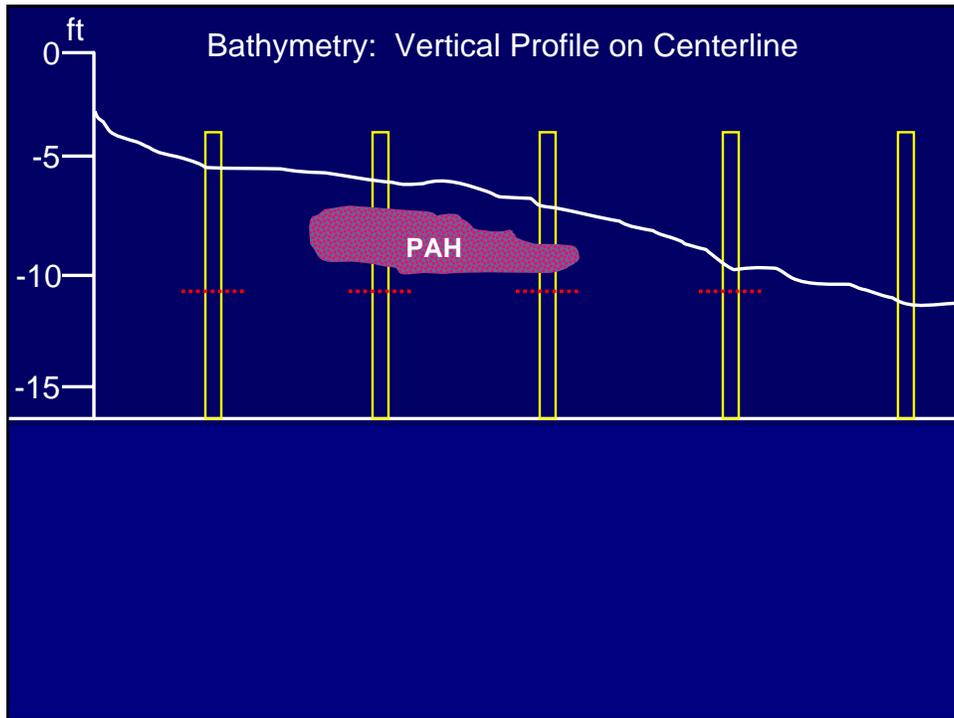
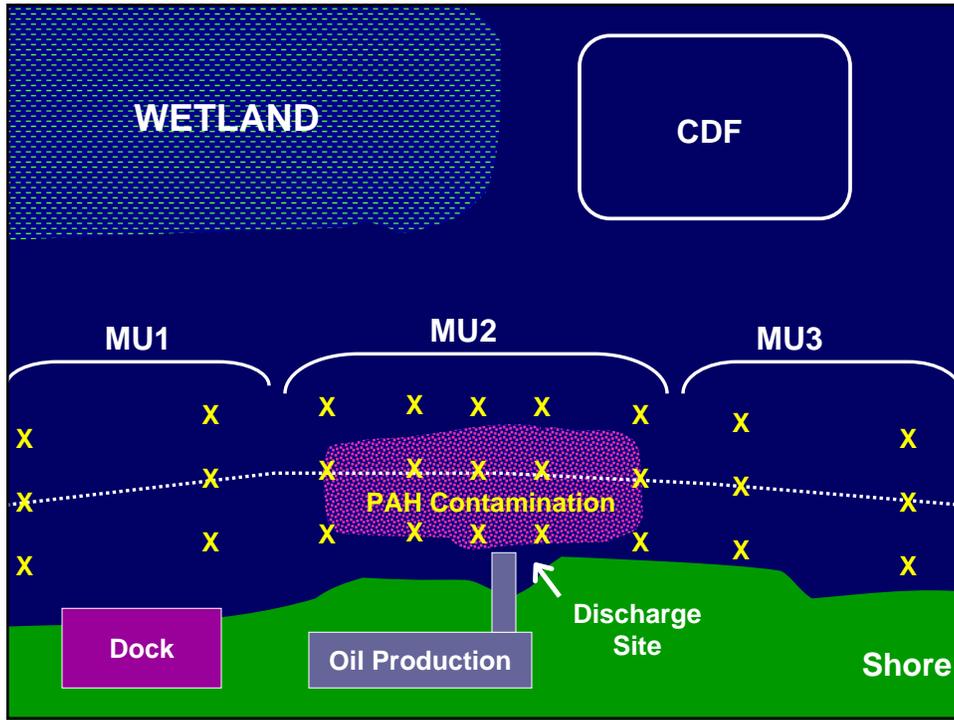
Spatial Analysis and Decision Assistance

- www.clu-in.org/triad/



LA Bayou Case Study:

- Site with known PAH contamination
- Known contamination from historical oil production (stopped in 1990)
- Have some limited data from university study
- Need to characterize the presence and toxicity of contaminants



References

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